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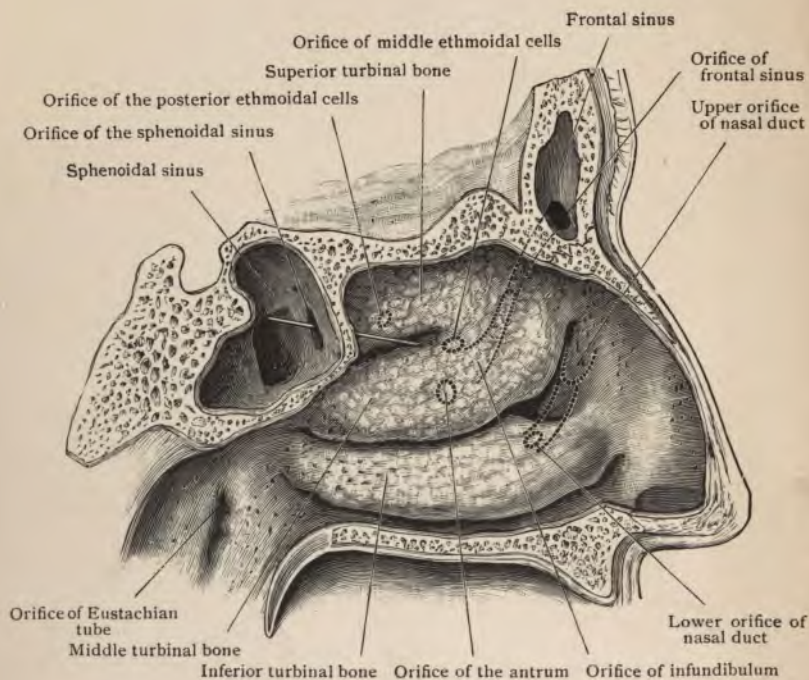
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HAY-FEVER
AND
ITS SUCCESSFUL TREATMENT
— — — — —
HOLLOPETER





SECTION OF THE NOSE, SHOWING THE TURBINAL BONES AND MEATUSES, WITH THE OPENINGS IN DOTTED OUTLINE.

HAY-FEVER

AND

ITS SUCCESSFUL TREATMENT

BY

BY

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PHILADELPHIA

P. BLAKISTON'S SON & CO.

1012 WALNUT STREET

1898

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WM. F. FELL & CO.,
ELECTROTYPERS AND PRINTERS,
1220-24 SANBOM STREET,
PHILADELPHIA.

L743
H73
1898

PREFACE.

Having had remarkable and uniform success with a simple treatment of hay-fever for the last ten years, during which time I have given complete relief to over two hundred patients in my private practice, and having made a thorough clinical study of this affection, as well as an exhaustive review of the literature relative to it, I feel justified in presenting the results of my labors in this short treatise.

There is little to be said definitely about the etiology of the disease. It is undoubtedly caused by an external irritant, possibly containing a micro-organism or a toxin, which becomes especially active in the nasal passages of an individual predisposed by systemic debility or local abnormality. We acknowledge the element of neurotic disturbance, but to dogmatically define its exact cause and *modus operandi* is beyond us.

In order that the best thought of the subject may be presented to the reader, I have compiled, arranged, and annotated the most worthy literature, and I acknowledge my indebtedness to the many writers quoted. The most of my original communication is devoted to the all-important point in the discussion—the successful treatment. A complete bibliography is appended.

W. C. HOLLOPETER.

1428 NORTH BROAD STREET,
PHILADELPHIA, *July, 1898.*

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HAY-FEVER.

Synonyms.—Autumnal catarrh, Bostock's catarrh, coryza vasomotoria, coryza vasomotoria periodica, hay-asthma, idiosyncratic coryza, June cold, July cold, nervous coryza, nervous catarrh, paroxysmal sneezing, peach cold, periodic hyperesthetic rhinitis, pollen catarrh, pollen poisoning, pruritic catarrh, pruritic rhinitis, ragweed fever, rhinitis sympathetica, rhinitis vasomotoria, rose catarrh, rose cold, summer bronchitis, summer catarrh, summer catarrh from idiosyncrasy, summer fever, typical early summer catarrh, vasomotor coryza, vasomotor rhinitis.

Latin eq.—Catarrhus æstivus, coryza vasomotoria periodica.

French eq.—Catarrhe d'été, catarrhe de foin.

German eq.—Frühsommerkatarrh, Heuasthma, Heufieber.

Italian eq.—Asma dei mietitori, febbre del fieno, asma del fieno.

GENERAL REMARKS.

The idea of an **external irritant** in hay-fever pervades most views of it. There can be no doubt, however, that there is usually an **underlying systemic condition** which renders individuals susceptible to the disease. It may, in addition, be accepted as conclusive that the **nasal abnormalities** found in hay-fever subjects are as often incidental as causative. They are seldom exclusively provocative of the susceptibility, and they are not the results of repeated attacks. Exactly what this underlying condition of susceptibility is has been variously regarded. The nature of the irritant has been widely and scientifically investigated. While all theories advanced are in part more or less tenable, none of them alone is satisfactory. The condition is always, however, one of lowered resistance, general or local. If general, it may be of neurotic, lithemic, idiosyncratic, gastric, intestinal, or diathetic origin. It is, therefore, my belief, that in hay-fever there is always, first, an exciting agent, and, second, a system predisposed by debility of some character

to the influence of this irritant. The overwhelming testimony as to the character of this irritant points to its derivation from something external to the body of the sufferer. Moreover, it is absolutely certain that without the action of an external irritant genuine hay-fever does not occur. The elaborate and ingenious experiments of Blackley, not only upon himself but upon other individuals, clearly indicated the pollen of flowering plants as an active, exciting cause. It has never been shown that, although pollen, healthy or unhealthy, may be a mechanical irritant and thus account for many cases, it is not also a chemic irritant when it has fallen upon a susceptible soil. It has been claimed that hay-fever is caused by a toxin generated by a fermentative process in the pollen which has fallen into the alkaline solution of the nose; and it has been shown that acid solutions stop the movements of many micro-organisms and spermatozoa, and that alkaline solutions in the nares have given little or no benefit in attacks of hay-fever. It has also been shown that the affection is more common among men than among women, and that the blood of the latter is the less alkaline.

Arnold, in 1896, stated that just what constitutes

the irritant is not determined, and said it is likely that not healthy pollen but some fungoid growth is responsible, since threshers of grain, at other times without ill-effects, have complained of attacks of hay-fever after threshing smutty or moldy grain, especially oats.

Helmholtz, himself a sufferer from hay-fever, discovered peculiar micro-organisms in his nasal discharges. These vibrios were never found by others, and this fact is supposed to controvert his theory. It has not been shown conclusively that they have been sought for by other investigators, and it is likely that they have not, since attention has been called away by the pollen and other theories. The antiseptic quinin solution employed by Helmholtz, while extensively used with good results for the subsequent decad, was not invariably accompanied by relief. Later, the relief that was given by quinin solutions was said to be psychic. This allegation may well be understood when it is considered that many other theories as to the causation of hay-fever, particularly the pollen, abounded soon after Helmholtz's expositions.

Some very interesting investigations by Strangways, of St. Louis, in 1897, urged him to conclude

that the amount of pollen in the air is altogether too small to have an injurious mechanical, medicinal, or poisonous influence. He calculates that for every square foot of surface there is one ragweed, and inquiry showed that mere elevation of several hundred feet above the earth's surface does not give relief from this distressing affection. Strangways found that ragweed pollen probably floats to 1000 feet elevation; but, if the limit is placed at 500 feet, it would give for every plant 500,000 cubic feet of air, not for one day but for six weeks; *i. e.*, if the whole plant was pollen there would be still only one part of pollen to fifteen or twenty billion parts of air. The rose and the golden-rod are in even smaller quantities. Strangways' estimates showed that there was not more than one grain of pollen for every thirty respirations. He advanced the theory that, while pollen plays a part, it does not irritate mucous membrane nor produce vasomotor paresis by its direct influence, but that a **protoplasmic substance** found in pollen and in the vegetable kingdom, acting as a ferment, causes the formation of a toxin which is the real exciting cause.

There can be little doubt that the **neurotic ele-**

ment has been present in many, if not most, cases of hay-fever, and evidenced by depression, general lowering of tone, or exhaustion of the nervous system. The neurosis need not be acquired; in fact, it is often hereditary, which will be discussed later.

Holmes believes the disease to be in great part a neurosis with other debilitating conditions. The fact that the better educated classes are most prone to this affection indicates the influence of neurotic tendency as well as exhaustion of the nervous system or debility or depression thereof. The premonitory symptoms of this affection, as ably shown by Sajous, show the neurotic elements. He well asks, "If the local irritant is the only cause, why does the respiratory tract, the portion of the body first and most exposed to its effects, not become immediately influenced?" This author also shows a case following enteric fever, the debilitating and exhaustive character of which is well known, one preceded by malarial fever and another by bronchitis, pertussis, and varicella.

Of the various other theories advanced are the lithemic, the intestinal or gastric, due to lack of proper assimilation, and the uric acid diathesis.

The views herein advanced are not at all inconsistent with the idea that the diatheses exercise a predisposing influence in producing the affection, which influence is debilitating and devitalizing.

The **local theory** alone is not conclusive nor satisfactory; viz., that the disease is due to chronic nasal catarrh, or a local lesion, upon which the exciting cause acts. There is no doubt that diseased areas are more sensitive to the irritant, and especially so in cases of lowered vital energy and lessened normal resistance, general or local; but a large number of cases show no local disease.

In all of the theories respecting this affection there is more or less regard for the agency of pollen in provoking the paroxysms of the disease; but as every one is exposed to the irritant, in those affected the soil must be prepared for the seed, that is, before the deposition of the pollen or dust or exciting agent there must be a morbid condition preëxisting, which can so far be characterized as to call it lowered vitality or general or local resistance, which springs from a variety of causes.

HISTORY.

Exactly when hay-fever was recognized as a distinct affection is not known. Beschorner shows that it was known in the sixteenth century. In 1565 Botallus reported a case. Van Helmont and Binninger in the seventeenth century speak of it. A similar distressing catarrhal affection, but due to the rose, is instanced in "Acta nat. curios. Ephemerides," Dec. II, Ann. V, obs. 22, and again in the same journal, Dec. III, Ann. V and VI, obs. 193, a case of annually recurring profuse nasal catarrh is mentioned. John Floyer, London, 1698, noticed that there were peculiar cases of asthma in which the attacks were longer and more acute in summer than in winter. In Good's "Study of Medicine" there is a reference to a case related by Timæus in 1667, of an attack of an asthmatic nature caused by the odor of roses and ipecac. Riedlin, in his "Lin. Med.," p. 177, in 1695, wrote of the odor of roses causing a catarrh of the head, resembling hay-fever. C. L. Parry, of London, records a case in 1809 and another in 1811. Elliotson, in 1821,

tells of a patient who had had hay-fever since 1789, and of another who was sixty-six years of age and who had had the disease from his seventh year, *i. e.*, since 1755, and of a third who had been afflicted for many years.

Just when and where the term "hay-fever" or "hay-asthma" arose it is impossible to say, but probably it was popularly so named. The emanations from dry hay were first thought to have caused it. Dr. Bostock, who was himself a sufferer, in 1819, found that the laity knew of the affection, although it was not recognized as a distinct disease by the profession. He objected to the term "hay-fever," which was already employed to designate it in his day, contending that moist heat, sunshine, dust, and fatigue were more potent in its causation than emanations from dry hay. It seems remarkable that the profession in England were unfamiliar with hay-fever as a distinct affliction, especially as their king, George IV, was a sufferer from it. In 1828 Bostock, who had first described the disease to the Medico-Chirurgical Society of London as a "case of a periodic affection of the eyes and chest," published some further observations on the complaint

under the title "Summer Catarrh," or "Catarrhus *Æstivus*." In 1828 MacCulloch included it in his "An Essay on the Remittent and Intermittent Diseases," but advanced no special views. In 1830 Augustus Prater published notes of a case seen in Paris. In 1831 Dr. Elliotson, in London, briefly described the affection; and in 1833 he discussed the complaint more fully and opposed Bostock's theory of heat and rejected the hay-theory of its origin, but declared grasses to be more important factors; and he first pointed to pollen as the probable cause of the disease. In 1847 Dr. Ramadge detailed reports of cases and believed "effluvia from flowers" caused it. In 1850 Gream first alluded to dust as an exciting cause and proposed nux vomica as a remedy. In 1852 Dr. Laforgue, of Toulouse, wrote his essay "Observation de catarrhe d'été," in which he upheld heat as the cause, after the view of Bostock. But in the next year, 1853, in "L'Abeille Médicale," an anonymous contributor, reciting his own case, advocated hay-emanations and not heat as the exciting agent. In 1854 Phœbus, of Giessen, concluded from his study of 154 cases that sunlight was the active cause of the attacks. In

1857 Watson ascribed the malady to the presence of vegetable matter in the atmosphere. In 1859 Phœbus again published the results of his circular of inquiry. He went into the subject more thoroughly than any of his predecessors, and from sunlight he shifted to ozone as the theoretic cause of the malady. In this same year Hyde Salter named as the exciting agents "bright, hot, dusty sunshine," a full meal, and hay, and recited two interesting cases. Another writer, Walshe, in the same year, referred to hay-fever as a singular variety of nasopulmonary catarrh, and he first called attention to the fact that the disease, in his own person, "always disappeared in crossing the Atlantic."

In July, 1860, Dr. Cornaz, of Neufchâtel, Switzerland, in a paper on hay-fever, described six cases, and concluded that the flowers of grasses were the cause of the disease, and he was followed on the 20th of August of the same year by Dr. Labosse, of Nitry, France, in a paper entitled "Nouvelle Observation de Catarrh de Foin," in which he spoke of three persons whose symptoms occurred at the time certain flowers were in bloom. In 1866 strong light and great heat were ad-

vanced as aggravating causes by Dr. Wm. Abbotts Smith. In his published work, "On Hay-fever, Hay-asthma, or Summer Catarrh," he rejected the ozone theory of Phœbus.

In 1867 the nervous origin of the disease was first advanced by Dr. William Pirrie, who spoke of two forms,—one a spasmodic form caused by external irritants, the other arising from the action of light and heat upon the central nervous, the cerebrospinal, and sympathetic systems. In the same year, Helmholtz, who, though not a general practitioner, while suffering from hay-fever, began to treat it with a quinin solution and found that he was relieved thereby. Two years later he detailed to C. Binz, of Bonn, Germany, by letter, the history of his sufferings, and recommending his solution as a ready means of relief and even of prevention, which was in accord with the findings of Binz that the quinin solution was poisonous to infusoria. In this letter Helmholtz propounded the theory that the symptoms were caused by vibrios which, though latent at other times in the nasal fossæ and sinuses, were excited to activity by the heat of summer. It has since been thought that the organisms found by Helmholtz, by means

of the microscope, in the nasal discharges during an attack were probably fragments of mycelium-like threads which develop from pollen-cells under the influence of the heat and moisture of the nasal chambers and which contain the minute fovilla of the pollen-cells. The use of the quinin solution which Helmholtz so successfully employed on himself became very popular and found many strong advocates in the profession until the extensive researches of Blackley in regard to pollen in 1873. In the meantime, in 1870, Dr. George Moore advocated a complex theory of the disease, really combinations of preceding theories. In the same year Roberts issued a short, practical paper, claiming to be the first to observe excessive coldness of the tip of the nose as the "pathognomonic" symptom of hay-fever and desiring credit to be accorded him for this discovery.

In 1872 Morrill Wyman, of Cambridge, Mass., distinguished two different forms of the disease; naming that occurring in August "autumnal catarrh," peculiar to America, and that of the spring or early summer "June cold" or "rose cold," more prevalent in England.

Dr. Wyman first attempted to define the geo-

graphical limits of the disease, and called attention to the important fact that residence in certain elevated regions brought certain and complete relief in most cases of autumnal catarrh. He stated that a lady from Lynn, Mass., a great sufferer, accidentally observed in 1853 that her catarrh passed by while she was traveling in the White Mountains, and that for the following ten years she visited the region and escaped the disease. In 1860 Jacob Horton, of Newburyport, Mass., wrote Dr. Wyman that the White Mountains gave the only relief. In 1873 Charles H. Blackley, of Manchester, endeavored to show that pollen mainly, if not exclusively, caused the malady, and by extensive experiments showed that the amount of pollen in the atmosphere at great elevations was to that in the air at ordinary breathing levels as nineteen to one. He proved, by very ingenious and carefully conducted series of experiments, that the pollen of grasses and flowers was the sole cause of hay-fever in himself, and that in two other patients the severity of the attacks was directly related to the amount of pollen in the air. His subsequent observations made it extremely probable that pollen is an important factor in the

causation of hay-fever, although all kinds of dust may be sufficiently irritating to excite the paroxysms. This was in opposition to the views of Phœbus and of Pirrie, both of whom suggested heat, strong light, and ozone as the exciting causes. Pirrie had also suggested disturbance of the **central nervous system** as an important etiologic factor. He was supported in this view in 1876 by Morrill Wyman, then of New York. In the same year Beard, of New York, published his monograph, the information for which had been painstakingly gathered from replies to two hundred circulars which he had issued to medical men all over America, somewhat after the manner of Phœbus; although, unlike Phœbus, Beard had himself seen and treated many cases. From his data he drew the conclusion that the immediate exciting causes were more than thirty in number, and that secondary causes might increase this list to more than one hundred. He also showed from his statistics that the nervous temperament existed in a great proportion of the sufferers, and that nerve tonics were of some value. In 1877 Marsh, of Tuckerton, New Jersey, published an essay in which he accepted completely the pollen theory.

He first called attention, in this paper, to the activity of the pollen of *Ambrosia artemisiæfolia*, or common ragweed, as by far the most active of the pollens in America in producing the attacks.

In 1882 Daly, of Pittsburg, first called attention to the fact that a **diseased condition of the nasal cavities** was an important factor in the production of the exacerbations of the disease. Roe, of Rochester, in 1883, advocated the same theory, but added that "removal of the diseased tissue removes susceptibility to future attacks." In the same year, Sajous' essay appeared in which he advanced idiosyncrasy as a heretofore unconsidered element in the cause of hay-fever, and laid stress upon the three essential factors in the production of an attack; viz., first, an external irritant, second, a predisposition of the system, and, third, a vulnerable or sensitive area. In 1883 Hack accepted the local theory of the causation of the disease. In 1884 Harrison Allen, of Philadelphia, attributed the affection to a permanent or temporary obstruction of one or both nasal chambers. In this year, J. N. Mackenzie, of Baltimore, termed the disease "*coryza vasomotoria periodica*," be-

cause it is essentially a **coryza**. He says: "The well-recognized, but imperfectly understood personal susceptibility to certain forms of local irritation, which is the sad prerogative of sufferers from this disease, has always been the stumbling block in its investigation and the rock upon which the various speculations as to its nature have been wrecked." He demonstrated that "there exists in the nose a well-defined **sensitive area** whose stimulation through a pathologic process or through *ab extra* irritation is capable of producing an excitation which finds its expression in a reflex act or in a series of reflected phenomena." He thus claimed functional derangement of nerve centers as essential to the disease. It was also in 1884 that Sir Morell Mackenzie asserted that the universal cause of the disease was pollen, although he did not deny that other irritating particles, *e. g.*, ipecac, if persistently brought in contact with the mucous membrane of the nasal chambers, may produce it.

In 1885 Seth S. Bishop advocated the **uric acid** theory of the origin of the disease.

In 1887 Sir Andrew Clark, in the Cavendish Lecture in London, emphasized the doctrine of

the **three great causative factors**,—viz., first an exciting agent, generally pollen; second, the **neurotic habit**; and, third, a local morbid condition of the nasal mucous membrane.

Since then many articles have appeared upon the subject, but no striking innovations in the possible etiology of hay-fever have been offered.

In 1893 Macdonald said, we ought not to describe hay-fever as a disease but merely as a train of symptoms—a train of physiologic reflexes instigated by an unwarrantably small provocation in certain individuals more susceptible to the influence thereof than the rest of their kind.

Early in 1897 Grayson, of Philadelphia, stated that “the neurotic habit may exist but is not essential to the disease, and the nervous system is implicated as a victim, not as a culprit.” He claimed that hay-fever is a defect, not of the nervous, but of the **nutritive system**, believing that the digestive tract is the cradle of the systemic error.

In October, 1897, Edmund W. Holmes, of Philadelphia, stated his belief to be that hay-fever was largely a neurosis, originating in local disease of the nasopharynx, the characteristic manifesta-

tions being in part direct, the result of central nervous modifications, and in part reflex, from the action of various mechanical irritants, aided by local and constitutional factors when they exist, and by seasonable and climatic influences, the periodic and peripheric susceptibility being in particular expressions of certain impressions.

EXCITING CAUSES.

It being generally recognized that there are two elements entering into the causation of hay-fever, viz., an exciting agent and a predisposing or preëxisting condition, regard will be given the subject of causation from this standpoint.

A great number of agencies have been regarded as the direct causes of this disease, but opinion in the main has assigned pollen as the essential factor, acting upon the preëxisting condition or predisposition. It may be better, however, to give a résumé of other agencies before regarding this subject of pollen. The most important of these are heat, light, dust, ozone, overexertion, ipecac, lycopodium, coumarin, benzoic acid, chocolate, or several of these in combination.

Heat.—No attempt to signify or designate a definite cause was made by the early writers until 1819, when Bostock first described the malady and ventured the view that it was due to the influence of solar heat. He attributed his own

prolonged sufferings to the exposure to the sun's rays and fatigue.

Some time after, Phœbus attributed the affection to "the first heat of summer," which, he stated, "is a stronger cause than all the grass emanations put together." Phœbus subsequently modified his views so as to regard the first heat of summer as acting only in an indirect manner as an exciting cause, and admitted that hay and the blossoms of rye caused exacerbations. It can not be contended, at this day, that heat alone will provoke the disease. In the plains of India when the heat is greatest it is not found, although later in the year, in the cooler months and before vegetation is burned up, it does appear; but among the hills of India where the climate is milder and the grasses and cereals are in blossom hay-fever exists. At sea, when vessels are becalmed and heat is most intense, and in the great heat of the desert hay-fever is not found. Pirrie shows that great heat is common to all cases, even when the vegetable world is looked to for the cause, and strangely points out that the premonitory feelings of an attack coincide with those caused by high temperature. One of the most interesting cases

from this standpoint is that of an Englishman, who, although not a medical man, is well known to science—Richard Proctor. The asthma—for it took this form—occurred only during the cold months, and was always aggravated by a rime or hoar-frost, especially if the latter was followed by a bright, sunny day.

It is a striking fact that in regions comparatively free from the disease persons subject to it become worse on warm days, or when the wind blows from the South. It has been found by experience that while this aggravation by winds is in most part due to the presence of more pollen, the higher temperature is also in a measure responsible. Hot, dry days are more favorable to the dissemination of pollen than rainy ones, and it becomes especially active when hot, dry periods follow stormy weather. In the light of Blackley's experiments upon the amount of pollen in the atmosphere, these facts would seem to explain the action of heat and sunlight as an active cause in the production of the exacerbations of hay-fever.

Light.—Phœbus was dissatisfied with the view of the influence of solar heat, and thought that the longer days, which produce a more continuous

action of light, were perhaps to blame; but where light is strongest and lasts the longest—indeed, in the land of the “midnight sun”—hay-fever is practically unknown. Pirrie called attention to the fact that exposure to strong light aggravated the symptoms of the attack. The foregoing case of Richard Proctor is an instance of the truth of this. There is an instance of the widow of a clergyman whose attacks, most severe in summer, were aroused by sunlight in the early morning. Ingals knew a clergyman who was unable to cross the street on a hot day without sneezing violently unless he carried an umbrella. Persons with sensitive mucous membranes, especially subjects of hay-fever, are, no doubt, sometimes liable to attacks of sneezing from sunlight; but these symptoms must not be mistaken for true hay-fever. Ingals states that he knew an individual in whom attacks of sneezing were brought on by exposure to bright gaslight. Gaslight was also regarded by Beard as a cause of this affection. However, Morell Mackenzie shows that gaslight is employed more in winter when the affection does not prevail than in the English spring and American autumn, when the affection most prevails. Nothing can

exceed the reflected glare of sunlight at sea on a bright day, yet it is upon the sea that exemption from attacks of hay-fever is universally found.

Dust.—From his scientific investigations upon the subject, Beard, whose published work is a model, concluded that it was extremely probable that dust occasionally caused hay-fever. Out of 198 cases of hay-fever reported by him no less than 104 attributed the affection to dust. One hundred and forty-two of these cases, however, occurred between May and September, the usual hay-fever season; and the lay, not the trained professional, mind advanced the causes. Some attributed the affection to "indoor dust"; some to "cinders." These data of Beard, therefore, must be taken *cum grano salis*. More especially is this so since a paroxysm of sneezing and subsequent coryza, frequently brought on in normal health by the mechanical irritation of dust or even strong odors, should hardly be dignified as an attack of hay-fever. In England, in February, March, and April, when strong east winds often blow clouds of dust against the face, the symptoms of hay-fever do not appear, whereas in June and July

when dust is comparatively little, the affliction is most extant.

Holmes stated that even in winter-time stirring among old books or in an old garret the exposure to the fine dust therefrom would, by simple mechanical irritation, produce an attack in him. It has been the consideration that dust, or pollen acting as any other form of dust, could be kept from entering the nasal chambers that has given rise to the various inventions to purify the air before it enters the nose, such as plugs of cotton or wool, and veils (which, in addition, soften the glare of the sun and lessen the irritating action of winds upon the face). Every hay-fever sufferer knows the little value of such device.

Ozone, Benzoic Acid, etc.—From the vast quantity of facts and observations gathered together by him, Phœbus, who previously had ascribed sunlight as the cause of hay-fever, endeavored to extract a complete theory of the disease. He suggested an excess of ozone in the atmosphere as a possible cause. It remained, however, for Blackley, in 1873, by his great endeavors and scientific methods of investigation, to disclose the fallacy of this theory. He pur-

posely breathed air highly charged with ozone for five or six hours without effect; and without inconvenience he inhaled ozone artificially prepared and in quantities far exceeding that found in the same volume of atmospheric air. This same physician also studied upon himself the effects of benzoic acid, a substance shown by Vogel to be contained in *Anthoxanthum odoratum* and *Holcus odoratus*, the two species of flowering grasses to which the causation of hay-fever has been attributed. Likewise he investigated the odorous principle of many flowering grasses, coumarin, and the volatile oils which impart to many plants, such as peppermint, juniper, rosemary, and lavender, their characteristic perfume. In all these cases the results were negative.

Various Other Exciting Causes.—These are in numberless variety and many of purely idiosyncratic nature. Emanations from dry hay, sunlight, gaslight, heat, minute organisms as supposed by Helmholtz, the “mange” insect, dusts of all kinds, bad air, railway smoke, brimstone matches, flowers and fruits, odors from dogs, cats, horses, cattle, rabbits, guinea-pigs, and wild animals, have all been held responsible for the paroxysms.

Ward Smith records linseed meal and mustard as exciting causes. Wm. Murrell mentions powdered **May-apple** (podophyllum), the effluvia of clean pocket handkerchiefs fresh from an ironing table, locust-tree blossoms, mulberry blossoms, and fruit. The exhalations from feathers have been regarded as causes. It is well-known that various drugs like ipecacuanha and lycopodium give rise to attacks, and sulphur has been mentioned as a cause. Sir Thomas Watson names a servant in St. Bartholomew's Hospital affected by ipecac. Cullen tells of an apothecary's wife who, whenever ipecac was triturated in the shop, had an attack of hay-fever. He also mentions the vicinity of a rice-threshing floor as a provocative cause. Itzigson tells of a merchant who had hay-fever paroxysms whenever fresh coffee was handled in his presence ; and it is recorded of a dyer that he could not work when the wood of the oak (*Quercus tinctoria*) was lying about. The author knows of a case in a physician in whom violent paroxysms of sneezing are induced by the tasting of chocolate. It is related in the "Twentieth Century Practice of Medicine" that a hay-fever patient fond of tomatoes and watermelons was unable to eat

of them during the usual hay-fever season without most violent disturbance of the gastro-intestinal tract. Bastian was subject to attacks of an affection like hay-fever while dissecting the *Ascaris megalocephala*, a parasite infecting the horse. Hyde Salter tells of a clergyman affected by the vicinity to a dead hare, and who was thus able to detect the presence of a poacher. H. Charlton Bastian had like effects from the "mange" insect of the horse. Ringer and Murrell tell of a young gentleman made worse by the vicinity of horses or stable people. Once, while in the theater, an attack suddenly supervened without any appreciable reason until a horse galloped upon the stage. Macdonald, in 1893, mentioned a patient who, two or three hours after having patted his horse with his gloved hand, inadvertently put it to his face, and was immediately seized with a violent paroxysm. The odor from the inner aspects of the legs of the horse was very irritating to one writer a "sufferer." Ringer and Murrell cite the case of a gentleman who, subsequent to an acute pleurisy, was ever after a subject of "hair-caterpillar asthma," and was immediately attacked if by any chance he touched a caterpillar.

The difficulty of sometimes finding some exciting agent is shown by the case of Drenger. After searching several years in vain for the cause of attacks of hay-fever caused by entry into a certain room in a house, and after ransacking nearly everything in the house, a mattress was suspected, and, upon removal, was satisfactorily shown to be the offending agent.

The odor of peaches, of violets, of the mignonette, of chocolate, of musk, and of peppermint, has come in for a share of the blame. Trosseau relates of himself that attacks came on when he entered a room in which there were violets. The botanist Broussais was often impeded in his work by attacks caused apparently by the odor of a rose. Hünerswolff and Morell Mackenzie each cite a case in which the perfume of the rose produced attacks of coryza. The former's account is in the "Ephemerides," and has been often referred to. The latter's case proved rebellious to treatment, and the sufferer had, at last, to banish these flowers from her garden. That this peculiar antipathy to flowers is often imaginative is shown by John N. Mackenzie, who cites the case of a subject of hay-fever to

whom he handed an artificial rose. Immediately an attack of rose-cold ensued. A patient mentioned by Morell Mackenzie, while gazing upon a picture of a hay field, was seized with an attack of hay-fever. These last two instances indicate the psychic influence rather than any extraneous cause, but they serve to show the varieties of exciting agents.

The Pollen Theory.—The external cause which has been by far the most generally recognized and accepted as the most frequent is pollen. The older writers upon this theory did not distinguish the underlying condition necessary before pollen could act as a cause of the disease. The remarkable and elaborate **experiments of Blackley**, from 1866 to 1878, conclusively prove that a most important exciting cause of hay-fever is found in the action of pollen upon the mucous membrane of the nasal cavities. In his own person he showed that the inhalation of pollen always brought on the symptoms of hay-fever; that there was a direct relation between the intensity of the symptoms and the amount of pollen in the air, and that none of the other agents referred to, such as heat, light, ozone, dust, or odors,

would, of themselves, cause the distress. His range of observation included the pollens of various grasses and of cereals and of plants of thirty-five other natural orders. His experiments were made in the hay-fever season in England, between the end of May and the latter part of July, and showed that ninety-five per cent. of the pollen contained in the atmosphere belonged to the *Graminaceæ*. The apparatus from which he obtained the most satisfactory results in his investigations consisted of a vertical plate of glass, $\frac{7}{8}$ of an inch in diameter. It was covered with a hood, and was pivoted to an upright staff. A weather-vane surmounted the hood to control the face of the glass-plate before the wind. Upon this glass-plate was affixed a microscope cover-glass, one cm. in diameter, covered with glycerin. Any pollen floating in the atmosphere would thus be carried upon the plate by the wind-current and adhere to the glycerin upon the glass-slide. Blackley thus found that the amount of pollen caught upon the plate increased progressively from the seventh to the thirtieth of May, when twenty-five grains were counted, to seventy-six grains on the eighth of June, and to 280 grains on

the tenth of June. On the twenty-eighth of June 880 grains were counted, after which date they decreased until the first of August, when they had completely disappeared. Bright, sunny days brought large quantities of pollen, while rainy days decreased the amount. Passing showers ameliorated the individual symptoms, though not affecting the amount of pollen deposited upon the slide. Blackley also clearly showed that the mucous membranes of the nasal fossæ were not affected by pollen in the atmosphere when twenty-five grains per diem only were deposited on his glass, while seventy-five grains in twenty-four hours would irritate in certain individuals. When 280 grains of pollen per day were deposited the direct action upon the mucous membrane of this quantity would result in complete vascular dilatation.

Clinical observation has shown a parallel, but by no means a complete, analogy to the above phenomena in the action of cocain in different strengths of solution.

Emanations from the rose and from rye have been shown to have caused coryza, occlusion of the nostrils, and sneezing for from six to eight

hours. The sweet-scented vernal grass (*Anthoxanthum odoratum*), sweet-scented soft grass (*Holcus odoratus*), meadow grass, meadow fox-tail, Indian corn, barley, wheat, oats, bean-flowers, lilies, elder trees in bloom, the golden-rod, hay, timothy, and clover, and others may be mentioned. In America the pollen of the **Roman wormwood**, **rag-weed**, or **hog-weed** (*Ambrosia artemisiifolia*), is the most commonly referred to. It is very common in nearly all the States. It blossoms in August and September, the prevalent time of hay-fever. Wyman and his son, who had fled to the White Mountains to avoid hay-fever, were immediately attacked when a package of the rag-weed was opened there. The seashore, usually exempt, sometimes is not so, probably due to the presence there of the pollen of the *Artemisia gallica*, another kind of wormwood. In England the *Anthoxanthum odoratum*, or "sweet-scented vernal grass," seems especially causative. There must also be mentioned the common daisy (*Bellis perennis*) of England; also the rye-grass (*Lolium perenne*) and "sweet-scented soft grass" (*Holcus odoratus*). In Germany the rye-blossom is chiefly indicated as a cause. In Australia the Cape Weed pollen is

regarded as most commonly provocative. It covers the hills round about Adelaide to the height of some thousand feet or so. Most of the population of Adelaide are affected with hay-fever during the time of its blossoming, viz., in September. In India, where the malady occurs chiefly in February, it is the blossoms of the mango-tree (*Mangifera indica*) that are held responsible.

J. C. Wilson holds that most subjects are not sensitive to emanations from hay, and points out that there are no distinctive bacteria to give rise to the affection. Marsh, himself a sufferer, stated his belief in the pollen theory, conceiving hay-fever analogous to *Rhus toxicodendron*, or ivy-poisoning of the skin.

There are two authentic cases which would impair the pollen theory, the well-known exemption of hay-fever subjects at sea being granted. One is mentioned by Walshe, in which a passenger retained his symptoms of hay-fever during a passage across the Atlantic. Abbots Smith has reported the other, in which the disease came on at sea nine miles from land. In this latter case, unfurling the sails in which a large quantity of pollen had been folded may explain the occur-

rence. In the former instance the diagnosis was by no means certain and the presence of some other irritant may have accounted for the distress. Moreover, it is by no means impossible for pollen to be deposited on a ship even when miles away from land. In speaking of the distribution of pollen Darwin tells of how the ground near St. Louis, in Missouri, has been so widely covered with pollen that it looked as if it had been sprinkled with sulphur. Pine forests, 400 miles south, were probably the place and distance from which it came: On March 16, 1883, in Philadelphia, ignorant people took for brimstone a shower of yellow pollen which had been blown from some distant pine forest.

After citing many of the various causative pollens Holmes says that he is "not aware that any specialized action has been proved; all act (if at all) by mechanical irritation." He also shows the punctuality of flowering on the self-same date yearly is an absurdity, depending, as the flowers do, upon the variations of the seasons. The date of the flowering of plants varies within certain limits, and he points out the mutability of the blossoming date, or, more rationally, its limited

variation, and further adds that "even as a mere irritant, as pollen affects comparatively few, it must act upon a condition which is preëxistent, which is, therefore, independent of and predominates it, else would the cause, pollen, produce it universally."

As already mentioned, it has been claimed that a toxin generated from pollen by a fermentative process in an alkaline solution is the cause of hay-fever.

PREDISPOSING CAUSES.

While millions of people are exposed to the exciting causes of hay-fever, comparatively few suffer from it, and that there is an underlying condition, predisposition, or idiosyncrasy, can hardly be doubted. Exactly what this is, or on what it depends, is unknown. Abbotts Smith as early as 1865 spoke of a predisposition to attacks of hay-fever as one of the principal causes thereof. As Holmes has shown, there must be individual predisposition, since the exciting causes, if pollens, are everywhere. This predisposition or idiosyncrasy has generally suddenly developed without apparent reason. It has been argued that it is systematic or central, and that it is due to some local abnormality of the mucous membrane, the capillaries; or the periphery of nerves. Once acquired, however, it is seldom lost, and it apparently increases with each successive year.

Race.—The influence of race is seen in the fact that the English-speaking people are the principal sufferers. In India, Africa, and Australia it is mostly the English and Americans who are

attacked. In America it occurs in nearly every State, although much more infrequently in the South. In Canada hay-fever is rare, especially in the maritime provinces. Wyman relates a case—the only one reported—of hay-fever in an Indian child. Beard mentions that Dr. Jacobi, of New York, who practised much among the Germans, had never met with a case in that nationality; and in the same city a similar observation was recorded by Dr. Chaveau, a practitioner among the French. Sajous has called attention to a curious fact in this connection—viz., that the principal sufferers, American and English, are the only great tea-drinking nations, and that this beverage may exert a depressing influence on nerve centers. It would be interesting to have some information as to the existence of hay-fever in China and Japan, the tea-producing countries. John N. Mackenzie, in 1884, gives the first recorded instance of hay-fever in a negro, a male of thirty-five, tall, well-proportioned, and respectable, the attack lasting from the second week in August to late in September. A sensitive spot was found on the left inferior turbinated bone, $1\frac{1}{4}$ inches within the

nostril, which gave origin to a most intense paroxysm of asthma on simple contact with the probe.

Geographic Distribution.—Reports of hay-fever have come from nearly every quarter of the civilized globe. It is seldom seen in the far North, and is more frequent in the temperate than in the torrid zone. It is seen more often in urban than in rural districts. The disease is by far the most frequent in Great Britain and the United States. In Norway, Sweden, and Denmark it is seldom found, and it is scarcely ever seen among the natives of Russia, Germany, France, Italy, or Spain. The English and Americans in India and Africa are the only ones who are affected by it. Macdonald, in 1893, said the Irish are certainly not exempt. In the north of Scotland it is very infrequent, while in the south of England the disease is more frequently found than in the north. In Australia and New Zealand it is occasionally found. Literature is strangely silent about South America, but this land is strange to us in many other ways. Pirrie gives an instance of an English officer in India suffering there when vegetation was altogether different from the forms met with in Eng-

land where his attacks had begun. The complaint has made its appearance in two instances when its victims were at sea; one, reported by Abbotts Smith, after shaking out the sails when nine miles out at sea; and another, reported by Walshe, in which the patient suffered throughout a voyage across the Atlantic. A "sufferer" records that numerous portions of England, especially the highlands and the sea-coast, and nearly all of Wales and Scotland are exempt from the disease. He also regards the upper side of the St. Lawrence River, most of the province of Ontario north of the Welland Canal to the Detroit River similarly exempt, and he states that the disease is wholly unknown to regions above the outlet to Lake Huron.

Wyman has considered the regions of America where hay-fever is especially prevalent. That portion of the country east of the Mississippi River and lying between the 35th and 45th parallels of latitude he regarded as the territory of prevalence. Canada and the Adirondack Mountains, the Appalachian range, and the elevated plateau throughout New York State he considered almost exempt from hay-fever. That

portion of the United States west of the Mississippi River he seemed to think, as did Beard also in his later investigations, was free from the disease. Beard based his reasons upon the lack of vegetation and the sparseness of the population. Bosworth regards as better reasons the rugged mode of life of the inhabitants and the consequent vigorous health of the frontier life. It is a curious observation, too, that certain portions of the White Mountains country, formerly regarded as invariably free from hay-fever, of late years, probably owing to the extension of civilization and its vegetation to these regions, are no longer exempt from it. Southern climates, to a certain extent, are exempt from the disease. Wyman thought it did not prevail south of the 35th parallel of latitude, with the exception of certain districts in the neighborhood of Milledgeville, Georgia, Montgomery, Alabama, and Beaufort, North Carolina. There can be little doubt that the affection is less common in Maryland Virginia, in the border States, and in the far West; that it is rare in the extreme South and on the Pacific slope. The zone between the 35th and 45th parallels of latitude practically includes the

hay-fever district. Even in this section, localities, from their proximities to large bodies of water or to oceans, to elevation or to absence of certain vegetation, afford immunity. A "sufferer" states that on Lake Michigan hay-fever is absent above Ludington, while on the Mississippi, in Wisconsin, it is present as far north as the Chippewa River, and in some seasons, in a mild form, it is seen in St. Paul, Minnesota. It is known to extend to the latitude of Memphis in the West, Knoxville centrally, and Cape Henry on the Atlantic. In 1896 W. W. Bulette stated, that in certain sections of Colorado there is a variety of the affection known among laymen as blossom or **cotton-wood fever**, and very prevalent in regions where the cotton-wood tree abounds. The symptoms are practically identical with those of the autumnal variety of hay-fever, except that the throat and bronchial irritations are intensified, and the course of the attack is somewhat shorter. Symptoms occur about the twelfth of April and terminate in the latter part of May, and rarely last longer than July 1st.

Heredity.—Beard's pamphlet was the first to show a radical departure from the pollen theory

and to establish that the neurotic habit was an essential factor. He showed that subjects of hay-fever often acquired the affection or the tendency to it through inheritance. The facts sustaining this view are of "a most overwhelming character." Wyman, himself a sufferer, records numerous cases in his own family through four generations. He proved the powerful influence of heredity in many of his cases. It even appears in childhood, he states, and quite generally in those of nervous diathesis. In Dr. Morell's family there were six sufferers from hay-fever besides himself. In the family of Henry Ward Beecher there were two besides himself; and Chief Justice Shaw's family contained seven. Bosworth says that eighteen of eighty cases disclosed direct heredity, while in thirty-nine there was either hay-fever or asthma in the family. Of the forty cases of Sajous', thirty-five per cent. had near relatives who presented clear histories of hay-fever, and forty-two per cent. had asthmatic relatives, while fifty-three per cent. of these cases presented a family history of either hay-fever or asthma. Morell Mackenzie has several times treated father and children for hay-fever at the same time.

Prince relates that five members of the same family were hay-fever subjects. One daughter of thirty years suffered with June cold ever since she was five years of age, every year save 1887, 1888, and 1889. Her grandmother, mother, and two brothers suffered alike. The daughter, convinced that mental or nervous influence affected her, in 1887, was treated by the "mind cure," and for three years subsequently was free from her symptoms. When the original mind curist was dead, in the fourth year, the symptoms returned as badly as ever. A "Christian scientist's" influence was tried in vain.

Sex.—There can be little doubt that males are more afflicted than females. Of the early forms of the disease, however, females seem more susceptible than males. Of 433 cases cited by Phœbus, Wyman, and Beard, only 142, about one-third, were females. Of 506 cases gathered from several authors, 342 were males, 164 females. Morell Mackenzie met with 38 cases in males and 23 in females. Men are the more exposed to the exciting causes such as dust, heat, pollen, etc., although females are the more neurotic. The proportion is about one female to three males.

Age.—Only to some extent can age be said to affect the disorder. The liability to hay-fever in the great majority of cases appears before the age of forty. The malady has been reported, however, as occurring for the first time in persons as old as sixty, and persons of seventy and upward have suffered. Of the cases of children who have been attacked the disease had manifested itself in the parents. It would have probably been regarded as a common cold, had not the parents been the subjects of the affection.

Education.—Most all writers on this subject have observed that the disease attacks the better educated classes and those of fair social position. It is rarely met with among the laboring classes. This would seem to emphasize the view that the disease is essentially a neurosis. From the notes of sixty-one cases of hay-fever in private practice, and the sight of many others of which no record was kept, Morell Mackenzie found all the patients persons of some education, and recalled having seen none among his hospital patients. Of forty-eight cases of Blackley, all were educated, and Wyman made the same observation. Holmes has shown that the ignorant classes are not so likely

to recognize the disease as a distinct affection, and apply for medical aid.

Occupation and Mode of Life.—The fact that the rustic is much less subject to this disease than the dweller in the city and town, shows the influence of the mode of life. Farmers and agriculturists, exposed, it would seem, far more to the exciting causes than others, are peculiarly less liable to suffer from it. Beard reports only seven such cases among 200. Morell Mackenzie states that it is impossible to tell whether the villager owes his exemption to the maintenance of vigorous health by an outdoor life, or to habitual exposure to the cause of the complaint.

Holmes admirably points out that “a part of the mysterious origin must be set down to the indifference of the sufferers who, from year to year, have forgotten their periodical affection and failed to consult physicians.” He says: “Of similar cause is the groundwork of the assertion that it affects only the wealthy. This is simply because with this class there is a higher intelligence and closer attention to ailments, and the fact that having once discerned the actual condition, they, in many instances, take professional advice or go to a place

of refuge, thus drawing notice to themselves, all of which things are denied to the lower (poorer) classes. It is said that there are some 200,000 sufferers in the United States, at least within the range of observation of the Hay-Fever Association, which, meeting annually at Bethlehem, N. H., may be held to represent the more stable and well-to-do. From my own experience and observation I am convinced that there are many of our working people who suffer from this affection who do not even recognize the disease." Merchants, professional men, persons of sedentary habits and brain workers supply most of the victims. The disease is not so uncommon among hospital outpatients here and in England as formerly.

The Neurotic Theory.—Concerning the influence of the neurotic tendency, Beard pointed out, in 1876, two popular misconceptions of the nervous theory, first, that nervous susceptibility implies debility and emaciation, whereas the nervous temperament is consistent with great strength and power of endurance, especially when combined with the bilious and sanguine temperaments; and, second, that the nervous theory dispenses entirely with the influence of exciting causes, as heat,

pollen, etc. Beard concluded that the disease is a complex resultant of a nervous system especially sensitive in this direction and acted upon by the enervating influence of heat and by any one or several of a large number of vegetable and other irritants, and this view has the advantage over other theories in that it accounts for all the phenomena exhibited by the disease in this or in any other country. He believed that the transmissibility of the disease from parents to children; the temperaments of the subjects; the capricious interchange of the early, the middle, and the later forms; the periodicity and persistence of the attacks and their paroxysmal character; the points of resemblance between the symptoms and those of ordinary asthma; the strange idiosyncrasies of different individuals in relation to the different irritants; the fact that it is a modern disease peculiar to civilization; the fact that it most abounds where functional nervous disorders are most frequent and is apparently on the increase *pari passu* with other nervous diseases; and, finally, the fact that it is best relieved by those remedies which act on the nervous system,—all these otherwise opposing

and inconsistent phenomena are by this hypothesis fully harmonized. Prince remarks that although a nervous origin has been recognized by some, still no theory has been proposed to show the connection between the physical symptoms and the nervous processes nor the pathology of the nervous processes themselves.

Vasomotor susceptibility has been viewed as indicating the neurotic tendency, and this may or may not be due to a central lesion. John N. Mackenzie regarded disordered functional activity of the nerve-centers as the expression of the nervous origin. Again, a general neurosis disposing to vasomotor disturbance of the sympathetic and the trigeminus nerves has been held responsible. Kinnear speaks of two forms,—one a hyperemia, and the other an anemia of the sympathetic ganglion. Bosworth is inclined to think a peculiar lack of vasomotor control characterizes the neurotic manifestations. In asthma there is undoubted vasomotor paresis of the blood-vessels of the bronchial mucous membranes, while in hay-fever it is of the nasal mucous membranes.

Solis-Cohen regards hay-fever as generally a neurosis, primarily a vasomotor ataxia or idiosyn-

crazy. Another view is that it may be due to an organic alteration of the nerve-fibers terminating in the nasal region and chiefly in three reflex areas. Again, that it may be due to functional activity or paresis of the governing (vasomotor) centers, accompanied by hyperexcitability of the erectile (cavernous) tissues aroused by peripheral irritation. The phenomena of the cavernous nasal tissue, though secondary to the centric condition, indicates a vasomotor disease. Hack and Robinson believe the morbid lesion is one of neurotic disposition with hyperesthetic condition of the olfactory and fifth pair of cranial nerves.

Idiosyncrasy.—Analogous to the neurotic habit is idiosyncrasy. Apparently the same understanding as to what an idiosyncrasy is has underlain the use of this word by various writers who have advanced idiosyncrasy as a cause of hay-fever. Morell Mackenzie, in 1880, put it down as a predisposing cause, but does not say upon what the idiosyncrasy depends, whether upon some local abnormality, the capillaries, the nerve-centers, or the periphery of the nerves.

In 1897 S. Solis-Cohen said idiosyncrasy is a real condition in hay-fever, and cited the idiosyn-

crasies to salicylic acid, quinin, ipecac, opium, etc., as similar to idiosyncrasies that patients exhibit toward the different irritants capable of producing hay-fever. Using the word to express the fact that certain persons react differently from most of mankind to certain forms of irritation, it means something. It means that such persons are abnormal, although the cause of the abnormality remains to be discerned. Holmes, speaking of idiosyncrasy, would not say there is no such thing as idiosyncrasy, but as far as hay-fever went, he held that the disease was an actual one, the nature of which was not yet comprehended. He remarks that it is quite probable that uric acid would aggravate hay-fever as it would any other condition in the body; and that some think to have proved this by the use of salicylic acid, to which drug many persons have an idiosyncrasy, thereby aggravating the condition in hay-fever by the elimination of uric acid.

Dr. Samuel Ashhurst, in 1897, recorded his habit of regarding hay-fever of late years as a personal idiosyncrasy acted upon by some irritant, and observed that without this personal element it is difficult to account altogether for the symptoms and their peculiar periodicity.

Local Disease Theory.—In 1882 Daly advanced the theory of the local disease as causative of hay-fever, and reported a case in which the patient recovered after the removal of a nasal polyp, which by continuous mechanical irritation had doubtless given rise to the condition underlying. Examinations of the nares of hay-fever patients have repeatedly failed to show any local disturbance other than general congestions. Daly's theory was subsequently accepted and supported by Hack and Roe, who both affirmed that the influence of a morbid condition of the nasal mucous membranes favored the development of hay-fever. In 1883 Sajous and Herzog wrote important papers to prove the same facts. In the same year J. N. Mackenzie demonstrated that "there exists in the nose a well-defined **sensitive area** whose stimulation through a local pathologic process, or through an extra irritation, is capable of producing an excitation which finds its expression in a reflex act or in a series of reflected phenomena." He located this area at the posterior end of the inferior turbinated bones and corresponding portion of the septum. It has since been held by advocates of the local theory, that

diseases and abnormalities of the nose, such as a markedly deviated septum, outgrowths from the septum, hypertrophic rhinitis, enlargement of the inferior or middle turbinated bodies, mucous polypi, and marked turgescence of cavernous tissue on the inferior turbinated body, were all provocative of hay-fever paroxysms.

In 1884 Harrison Allen declared that the primary lesion was one of **obstruction**, temporary or permanent, in one or both nostrils, from one of various causes, attended by vascular dilatation. Bosworth likewise held that the existing morbid condition of the intranasal tissues must be one of an obstructive character, tending to produce in itself vascular dilatation. Regarding nasal polypi, occasionally considered as active causes of hay-fever, Bosworth concludes that they are rather a result than a cause, since the great quantity of outpoured serum makes the nasal mucous membrane sodden or water-soaked, and in this way myxomatous degeneration develops, eventually assuming the form of polypi.

J. N. Mackenzie, however, examined the nares of many sufferers from hay-fever without finding any nasal lesion. Holmes noted an instance most

carefully reported, in which, with cold snare and galvanocautery, all obstructions were removed, and areas rendered anesthetic so that a probe no longer excited reflex symptoms, yet the patient suffered from hay-fever with scarcely diminished intensity. He further observes that at least a degree of the condition might be the result and not the cause, the peripheral susceptibility being an outward expression of an inward state.

In 1885 Thornwaldt, in Wiesbaden, in his observations on nasal catarrh, assumed that nasopharyngeal disease might not only give rise to symptoms simulating nasal disease, but was likely the actively predisposing cause of asthma and hay-fever. Bosworth agreed with him as far as hay-fever is concerned.

The Uric-Acid Theory.—In 1893 Seth S. Bishop announced to the American Medical Association that “an excess of uric acid in the blood causes hay-fever, or nervous catarrh.” Uric acid in the blood in marked excess of the normal relation to urea, of about one to thirty-three, causes certain disturbances of a vascular and neurotic character. In health, five to eight grains of uric acid are secreted every twenty-four hours. Haig

claimed that an effect of an excess of uric acid is contraction of the arterioles and capillaries all over the body. He found that by diminishing the alkalinity of the blood it was freed from uric acid, the arterioles were relaxed, and the headaches and mental depression were relieved. Cerebral anemia has appeared to obtain in hay-fever, and the attacks were relieved, Haig found, by such remedies as relieved anemia of the brain, *e. g.*, amyl nitrite, coffee, and other cerebral stimulants. These views of Haig were concurred in by Thomas J. Mays, Murchison, Conklin, Ebstein, Quinquaud, and others. Bishop, in 1894, remarked that the blood in the morning is more alkaline than at any other time of the day, being, at about nine o'clock, at its greatest point of alkalinity, which would seem to account for those attacks of hay-fever which came on early in the morning, and which in some instances were ascribed to the influence of light. He was of the opinion that not only an excess of uric acid in the system, but also an increased formation thereof should be regarded in the treatment of hay-fever. Bishop also claimed that the uric-acid theory was not antagonistic to the essentially neurotic character of the

disease. He also advanced that the primary determining cause of the particular manifestations in this disease is an inherent, perhaps hereditary, susceptibility of the nervous system. In this way only can we account for the fact that the same subjective or objective exciting cause (uric acid or pollen) will produce one train of distressing symptoms (nervous coryza) in one individual, and an entirely different one in another (asthma). This uric-acid hypothesis explains why some persons suffer from attacks under certain conditions in winter as well as during the warm months. It also unifies all the forms.

Bishop says: "The uric-acid theory of hay-fever is not antagonistic to the present status of medical opinion or surgical treatment, but, on the contrary, it explains questions that were inexplicable before. As a tumor or hypertrophied bone may give rise to convulsive seizures in epilepsy, and as its removal may be followed by relief when no other structural cause exists, so in hay-fever, when new growths and other lesions of the nasal mucous membrane are present, the attack may be started by the accumulation and the sudden setting free of uric acid. This pre-

cipitates the paroxysm by its irritant action, which finds expression in the group of symptoms characteristic of hay-fever or asthma, instead of some one of the other allied diseases. The particular form of manifestation may be determined by the growth or the seat of irritation located in the nasal cavities. When this is the only determining factor of the nature of the morbid symptoms, no other disease having resulted from the long-standing trouble, the removal of such a peripheral source of irritation may give relief from these symptoms, but it may not prevent the uricacidemia from switching off into other kindred lines of disturbances, if it be not corrected."

Capp, in advancing a new view, inclines to the uric-acid theory, and alludes to a certain spastic condition not mentioned by other writers, which, although slight in character, is general, rather than confined to limited areas, and in a large measure accounts for many manifestations of the disease. A central nervous irritation is probably caused by the presence of a disturbing element in the blood, presumably products of imperfect metabolism not eliminated. This may originate

nerve-currents with innumerable reflexes, which, in the disturbed equilibrium of the system, are, in a measure, uncontrolled by the ordinary inhibition.

Holmes has very cleverly pointed out a fallacy in regard to the evidence advanced to substantiate the uric-acid theory. He states that some investigators by the use of salicylic acid and various acids to diminish the alkalinity of the blood thus eliminating uric acid, have, thereby, actually aggravated the condition in hay-fever, which aggravation has been thought due to excess of uric acid in the tissues, or increase in its production, instead of being due to the idiosyncrasy to salicylic acid, etc.

In 1897 Grayson stated that even if we grant that a certain number of hay-fever patients are unquestionably people of a neurotic temperament, while others are gouty, can not we profitably look beneath these titles and recognize the fact that they are dyscrasias, which are merely different offshoots from a parent weed that is rooted in defective nutrition? By defective nutrition is meant all the phenomena of metabolism,—constructive, destructive, and eliminative. Disturb-

ance of one means disturbance of all. With continued absorption of toxic materials from the intestinal tube, or with persistent incomplete elimination of the products of suboxidation, it is only a question of time when autotoxemia will provide us with any of the functional neuroses from hay-fever and asthma to chorea and epilepsy.

Grayson says the neurotic habit may exist, but it is not essential to the disease, but the nervous system is implicated as a victim, not as a culprit. He claims that hay-fever is a defect, not of the nervous, but of the nutritive system, because impairment of the digestive and nutritive processes is almost invariably the first downward step toward a general state of lowered vitality. At first gastric, it later involves the whole gastrointestinal tract. He thinks uric acid is almost invariably present in excess in hay-fever subjects. A child having reflex convulsions due to acute indigestion is not a neurotic subject, yet the vasomotor perturbation of the hay-fever patient differs from that of the child mainly in point of chronicity.

Grayson concludes that the three factors which make up the etiologic combination of hay-fever are: An external irritant, some intranasal abnor-

mality, and a constitutional element—"defective nutrition." The physician unaided can not restore the nose to a state of health. In order to overcome the self-indulgence of the patient, regularity is recommended in eating, work, and play, while indiscretions of diet, lack of exercise, objectionable fancies in matters of clothing and bathing, and, finally, vicious excesses—alcoholic, narcotic, or sexual—will require the constant and most determined effort of the patient himself. The whole environment of the patient must be separately studied and provided for in the dietary scheme. A comment on this treatment is: "While it is true that if a man takes care of his muscles his nerves will take care of themselves, there is no closing of the eyes to the fact that to the average man exercise is distasteful; therefore, it is the more necessary to be explicit in instructions concerning it. Though there is nothing brilliant about this method of removing the constitutional factor of the disease, what it lacks in brilliancy is more than made up in certainty, and if the patient is possessed of grit and determination it brings a sure reward."

J. Müller thinks there is a causal relation

between hay-fever and gastro-intestinal symptoms, but he also holds that it can be proved that pollen entering the respiratory tract is the cause of the disease. A "sufferer," writing on the disease, says: "Indigestion is a most potent cause in many instances, and proper food, properly digested and assimilated, has permanently relieved more than one." But he does not say he himself was relieved, nor does he give cases.

It is questionable whether or not the digestive disturbances are not effects rather than causes of the disease. It is not at all doubtful, however, that lowered resistance and a depreciated vitality may result from difficulty in the gastro-intestinal tract. Such difficulty may suffice to start the chain of hay-fever symptoms.

TIME OF OCCURRENCE.

On the continent of Europe, where it is less frequent, and in England hay-fever prevails in June and July. The initial attacks occur during May and June and seldom last longer than September. In India the malady chiefly occurs in February. In Australia, in and around Adelaide, where the disease prevails, it occurs chiefly in September during the time of the blossoming of the Cape weed. In his work on hay-fever, Beard essays to show how the autumnal form is peculiar to the United States. One cause seems to be the flowering of the Roman wormweed and the pollen of corn about the middle of August, and another in the prevalence of the "dog-days." A third reason lies in the fact that there is less atmospheric ozone and electricity at this period than at any other time of the year, and, again, the hottest days are frequently in the latter part of June. Beard also attached importance to a variety of hay-fever in which the attacks came on in September. This distinction is probably due to the fact that while one person is liable to the action of

one pollen, another may be affected by a totally different pollen, and the annual attacks come on when the atmosphere is permeated by a special pollen to which the victim is individually susceptible. Many persons are susceptible to the action of more than one pollen. Patients often suffer from rose colds in early summer, and, again, in August, from the autumnal form of hay-fever. Of the 198 cases collected by Beard the onset of the disease occurred—

From May	1 to May	10, in	2 cases.
" "	10 " "	31, "	6 "
" June	1 " June	10, "	11 "
" "	10 " "	30, "	8 "
" July	1 " July	10, "	6 "
" "	10 " "	20, "	6 "
" "	20 " "	31, "	7 "
" Aug.	1 " Aug.	10, "	7 "
" "	10 " "	20, "	81 "
" "	20 " "	31, "	54 "
" Sept.	1 " Sept.	10, "	7 "
" "	10 " "	20, "	1 case.
" "	20 " "	30, "	2 cases.

Of Bosworth's eighty cases the greatest number, fifty-one, occurred between August 10th and August 27th. The usual date assigned for the commencement of paroxysms of hay-fever is the 29th of August. This form of the disease, com-

mencing in the latter part of August, is designated as autumnal catarrh.

Many patients have asserted that they are attacked annually on exactly the same date, and even the same time of day, each year. There can be little doubt that the psychic influence or peculiar mental anticipation may have a great deal to do with this circumstance. An attack may be brought on by the influence of the imagination. Phœbus gives the history of a case in which attacks of sneezing were brought on "while looking at a beautiful picture of a hay field." The well-known instance of J. N. Mackenzie, in which an attack of hay-fever was brought on in a susceptible individual subject to rose cold by means of an artificial rose may be explained on this ground. Bosworth considers that the time of occurrence is influenced by psychic causes, and is analogous to the recurrence of chills in intermittent fever, and considers that deception as to the actual time of occurrence might be proved in hay-fever as in intermittent fever, in which changing the hands of the clock may lead to a change in the regular recurrence of the chills. Prince gives the history of a case in which a hay-fever subject under the influ-

ence of autosuggestion, by means of writing frequently on paper and thinking, day and night, in leisure moments, and of slight hypnotism, prevented the premonitory symptoms of hay-fever, and she was free from the annual attacks for several years, when they recurred and continued yearly thereafter. Prince asks, may it not be that the reason why certain places, such as Dublin, for instance, are reputed to have a specific influence against attacks, is the counter-suggestion thereby given that the patient will be free from attacks at such places?

DURATION.

Pirrie states that it is next to impossible to definitely decide the duration of hay-fever attacks, as seasons, age, temperament, locality, treatment, and other circumstances tend to cause variations in different years and in different individuals. Treatment will do much to curtail the duration of the more prominent and distressing symptoms, but if left to themselves it is seldom they depart under three or four weeks. A writer in the "Twentieth Century Practice of Medicine" estimates the duration as from four to six weeks, according to the patient's surroundings and the atmospheric conditions. Asthmatic attacks may last from a few hours to three days and disappear suddenly. Morell Mackenzie states that attacks last from a few hours to several days, or even longer, finally ceasing almost as suddenly as they came, and leaving no trace either in local lesions or in systemic disturbance. Bosworth gives eighty cases, showing the durations of the annual attacks as follows:

From May 1 to frost, 1 case.
" " 15 " May 25, to July 1, . . . 3 cases.

From May 10 to Aug. 1,	. . . . .	1 case.
" June 1 " July 1,	. . . . .	2 cases.
" " 1 " " 14,	. . . . .	1 case.
" " 1 " frost,	. . . . .	5 cases.
" " 10 " July 4,	. . . . .	4 "
" " 10 " " 26,	. . . . .	5 "
" July 1 " Sept. 1,	. . . . .	1 case.
" " 10 " Aug. 1,	. . . . .	1 "
" " 10 " Sept. 1,	. . . . .	1 "
" " 25 " frost,	. . . . .	4 cases.
" Aug. 10 " Aug. 27, to frost,	. . . . .	51 "

All forms of hay-fever terminate with the first frost, and the long interval in which one may suffer is shown by the first case above from May 1st to cold weather. In the United States some who are attacked in May recover by the first of July; some attacked in July are well by the 15th of August; some attacked in August recover by November 1st, while some unfortunates suffer throughout the period from May to November. The June type may be followed by a September visitation or become a permanent August attack, or the August type may disappear in certain individuals and reappear as a June cold.

SYMPTOMS.

Although the affection is called hay-fever, there is seldom any degree of pyrexia, and, as a fever, it is not a decided one. There are two well-known **types** of the disease,—the **catarrhal** and the **asthmatic**. The onset of an attack is occasionally marked by feelings of general malaise, a loss of appetite, and depression of spirits. Indeed, these symptoms more or less characterize the entire course of the attack. A “tickling in the roof of the mouth” one week before the onset was felt by a patient of Sajous. Another speaks of dull pains in the head and back two weeks before; chills and shuddering ten days before the attack is experienced by another, while a large proportion complain of palpebral pruritus from two to ten days before the onset of the nasal symptoms. It is only in those subjects whose hay-fever is of some years’ standing, Sajous points out, that the **premonitory symptoms** are present, and gives in evidence the testimony of a fellow-physician, viz.: “My attacks for some years past came with much regularity, about August 12th to August 14th.

On these dates this year I arranged to be on the water, on Lake Ontario and the St. Lawrence River, and entirely escaped everything like sneezing and irritation of the nose and eyes. Still I had the usual hot and slightly irritable skin, then an eruption of urticaria, accompanied by disordered stomach. This experience is precisely the same as in 1880, except that then I was on the Atlantic." Macdonald, in 1893, had a patient whose earliest symptoms were a curious coldness and pallor of the nose even in warm weather. In this connection it may be observed that in 1870 Roberts conceived the "pathognomonic symptom" to be coldness of the tip of the nose.

Beard divided the symptoms into local and constitutional. Among the latter he regarded fever, loss of strength, the altered appetite and the nervous system, considering under this last, depression, indisposition to labor, sense of fullness and heaviness of the head, pain in the forehead and behind the ears, partial deafness, restlessness at night, inability to sleep, a sense of suffocation, and general irritability. For the local phenomena, he looked upon the skin, in the heart, chest, mouth and nose, eyes and ears.

The **periodicity** of the attacks is a prominent symptom and is difficult to explain. Some peculiar psychic influence occasionally acts to precipitate an exacerbation. In no other way can we explain the cases of John N. Mackenzie and Morell Mackenzie already cited. Analogous to this remarkable periodicity are those cases of intermittent fever wherein each alternate day, at a given hour, the chill occurs. This is generally true, moreover, not only of ourselves, but of the world around us. As Holmes has beautifully shown in this connection, health and disease afford abundant illustration: The fixation of the number of heart-beats, of the respiratory movements, of the cycle of menstruation, or of the period of gestation are all recognizable in their unfailing occurrence, but their determination thereof, then, rather than at some other period, can not be explained. So, in disease, are the mutations of the enteric temperature, the recurrence of the hectic, of the regularity of the return of the types of ague upon the second, third, or fourth days, or of hay-fever upon its annual date. We must recognize these phenomena as fixed, further we can not go. "As the rhythm of physiologic effects is under

the control of the central nerve ganglia, and as intermittency is a peculiarly marked feature of so-called nervous disorders, so far the annual return and the variations are evidences of the neurotic origin of hay-fever."

The onset of an attack of hay-fever begins with a sense of irritation referred to the upper nasal chambers, a sense of fullness or tightness across the bridge of the nose. There is an itching or burning sensation of the inner canthus of one or both eyes, which may be accompanied by convulsive movements of the eyelid, an itching or tingling in the roof of the mouth. Spasmodic sneezing soon occurs, and pain in the eyeballs and in the frontal regions develops. The paroxysms are more or less violent and prolonged. Arnold tells of sneezing in a patient for twenty-five times in close succession, forcing the pulse at the height of the attack to one hundred and twenty beats to the minute. These paroxysms are followed by an abundant, thin, serous discharge from the nose. The mucous membrane of the nasal fossæ swells so as to block up the nasal passages, and respiration through the nares becomes impossible. The escape of serum from the

nostrils seems to increase the intense irritation and makes the sneezing worse. The discharge from both eyes and nose gradually grows thicker and may become semipurulent. There is often a certain amount of chemosis, and sometimes photophobia, besides the usual pricking and stinging of the conjunctival surfaces. There are frequent transient paroxysms of lacrimation, and there is often much swelling of the eyelids as well as of the conjunctivæ. The face becomes puffy and edematous, and the senses of taste and smell become impaired. The pharynx, mouth, and tonsils share in the engorgement and become red, and simultaneously the inflammation of the eyes, nose, and throat becomes intense and painful. Swallowing may become so difficult that there is little rest night or day. Insomnia is common and is often attended by nervousness and a sense of suffocation out of all proportion to the gravity of the condition. Cough is not a constant feature, but in a considerable proportion of cases it comes on in the second week, and lasts through the attack. Generally it is spasmodic and so incessant at night that sleep is impossible, and there are soreness and pain resulting from the straining

of the diaphragm and intercostal muscles. **Bronchitis** does not usually result, and expectoration is absent or scanty until late. Cough may continue after all other symptoms have ceased. The pulse and **temperature** are not generally altered, but later in the attack the temperature may be raised two or three degrees, doubtless from disturbed rest. A "sufferer" records that, in some, the **genito-urinary** and **rectal** passages give the first warning by intense itching and burning. In one instance, a more than generally severe paroxysm induced rupture of the capillaries in the lacrimal caruncle of the right eye, causing engorgement of the organ and displacement of the visual axis, with consequent double vision for some days. The direct and reflex **changes in the vocal apparatus** vary from loss of timber and harshness to complete inability to utter nasal vowels and consonants.

The disorder varies much in intensity even in the same person within short intervals of time, so as to almost give an intermittent character to the complaint.

COMPLICATIONS AND SEQUELÆ.

The attack finally ceases almost as suddenly as it came on, leaving no trace of local lesion or systemic disturbance. It is accompanied in some patients with nettle-rash. **Asthma** is a late symptom, coming on after the acute symptoms have abated, and cough has existed for some time. It may appear at the height of the attack. It is more common in autumnal catarrh than in the early forms. Its period, as a rule, begins at the fourth week, and it does not vary from ordinary asthma. It is sometimes periodic, occurring at the same hour night after night. Paroxysms appear associated with antecedent bronchial rather than nasal symptoms. Nasal reflex phenomena, without cough, may occasion paroxysms. **Persistent cough** more usually exists in the intervals between paroxysms. Beard says that four-fifths of the sufferers have cough or asthma. The symptoms are not usually of equal severity each year. Asthma generally comes on in the daytime, a little ropy mucus being expectorated, and later, an abundant frothy secre-

tion. There may be only a slight remission, the dyspnea continuing so long as exposure continues. The attacks rarely produce emphysema of the lung, and sooner or later recovery ensues. Bosworth estimates that the asthmatic attacks come on earlier each year in those who have suffered from hay-fever in connection with asthma, and he believes that an attack of hay-fever is especially liable to develop an attack of bronchial asthma as a natural consequence of the disturbance in the nasal chambers. He also observed a number of cases in which hay-fever symptoms gradually abated while the asthma became a prominent factor, and, again, that victims of hay-asthma finally acquired the perennial form of the disease,—the attacks occurring at all seasons without reference to the presence of pollen in the air.

As already evidenced in Sajous' case, in a number of cases the attacks are preceded by **cutaneous eruptions**. Laflaive cites cases with urticaria and eczema preceding the onset of hay-fever. Facial pruritus and herpetiform eruptions are occasionally seen. J. N. Mackenzie speaks of an inflammation of the **external auditory**

meatus in all respects analogous to that of the nose in hay-fever, occurring repeatedly in a lady during the summer months.

Besides asthma, already mentioned, there is little tendency to permanent ill-effects except thickening of the nasal mucous membrane from the prolonged irritation. **Taste** and **smell** may be impaired during and for a long time after the attack. General irritability and nervousness may be more or less persistent. Elderly sufferers for a long time may have weakened hearts which intermit during attacks, which may recover with returning health or result in **cardiac dilatation**. Wyman mentions **pneumonia** in three cases during attacks. In one case the catarrh ceased for two weeks to return after the pneumonia disappeared, when asthma also came on for the first time.

PATHOLOGY.

Morell Mackenzie states that hay-fever, leaving no permanent structural lesion behind it, can not, therefore, be strictly said to have any pathology. Surely it is that no distinct specific organisms have been found. Sajous calls attention to the distinct physiologic functions of the two regions of the nasal cavities, the olfactory and the respiratory. The filaments of the olfactory nerve cover the superior turbinated bones, and the upper third of the middle turbinated bones, and the corresponding portion of the septum. Thus the upper portions of the nasal cavities are devoted to the sense of smell and do not enter into the pathology of hay-fever. The respiratory portion of the nose includes all the surfaces below the olfactory. It is under the control of the vasomotor nerves of the sympathetic system, and is quite sensitive to local or peripheral irritation. This sensitiveness resides in the terminal filaments of the sensory nerves, distributed over the surfaces of the mucous membranes. The membranes of the posterior areas of the nasal fossæ are supplied with several branches

of the sphenopalatine ganglion, which enter by the sphenopalatine foramen. This ganglion possesses a sympathetic root derived from the carotid plexus through the vidian nerve, thus establishing a connecting link between the nasal mucous membrane and the sympathetic system.

In health the nasal mucous membrane pours out from twelve to sixteen ounces of watery serum daily, which—that it may warm, moisten, and cleanse the inspired air on its passage to the lungs—is diffused over the convex surfaces of the turbinated bones. The centers in the medulla, through the vasomotor, control and regulate this process of serous exudation; the nicety of which regulation is seen in the adjustment thereof to the varying hygroscopic and thermic conditions of the atmosphere.

The experiments of John N. Mackenzie, in 1884, showed:

1. That in the nose there exists a well-defined sensitive area whose stimulation, through a local pathologic process or through an extra irritation, is capable of producing an excitation which finds its expression in a reflex act, or in a series of reflected phenomena.

2. That this sensitive area corresponds, in all probability, with that portion of the nasal mucous membrane covering the turbinated corpora cavernosa and the most sensitive spots covering the posterior end of the inferior turbinated body and the septum immediately opposite.

3. That nasal cough is caused only by stimulation of this area.

4. That the tendency to evolution of reflex phenomena varies in different individuals, and is probably dependent upon the varying degree of excitability of the erectile tissue.

These sensitive areas correspond to the distribution of the sphenopalatine branches of the superior maxillary nerve, as distinguished from the nasal branch of the ophthalmic, which latter supplies the more anterior portions of the nasal fossæ. The former nerves, derived through the ganglion of Meckel, therefore, probably contain the vasomotor nerves which govern the erection of the turbinated tissue, and, hence, the localization of the sensitive areas becomes the key to the mechanism of the paroxysms. Nevertheless, Beard was inclined to transfer the point of greatest excitability from the peripheral ends of the nerve filaments to

the **nerve-centers** themselves, because it seems a more comprehensive explanation of the varied phases of the disease.

Roe explained that the more frequent occurrence of asthmatic paroxysms at night might be brought about by the gravitation of blood to, or the contact of polypi upon, these sensitive areas. Sajous thought it was evident that there were three areas capable of producing reflex symptoms in the course of a paroxysm of hay-fever, and that the three combined formed the key to the local nervous element, not that the three areas must take part, but in some, one of them, in others, two of them, etc. In the asthmatic cases, he noticed that both anterior and posterior areas were sensitive, the latter especially so.

Capp pointed out two distinct spots or areas of the mucous membrane of the nasal cavities, one at the posterior and one at the anterior extremity of the inferior turbinates, one or both of which may be supersensitive in individual cases; also a spot in the anterior nasal chambers at the upper angle formed by the septum. All these are exquisitely sensitive, and, when irritated, produce extensive reflex symptoms. Trouble appears to

begin at one or all of the points, while the rest of the Schneiderian membrane is in normal condition; but with sneezing, hyperemia and hyperesthesia ensue, and, through continuity, may extend to throat, ears, and eyes.

In speaking of the three reflex areas, Holmes said that it is regarded that all points of the cavernous tissue are not equally susceptible to irritation; the sensitive areas are the inferior turbinates (the posterior and middle reflex areas) and the portion of the septum immediately opposite, being particularly related to cough and asthma; the anterior, in the vestibule, to sneezing, lacrimation, and other catarrhal symptoms. We might compare these reflexes with certain other cases of reflex asthma (not hay-fever) benefited by removal of the tonsils.

Bosworth regarded the continuous sneezing as pathognomonic and holds that the hyperemia is "confined entirely to the large venous sinuses, the capillaries proper not being congested," and speaks of the watery, serous discharge with the bluish-gray "tinge of the mucosa verging on opalescence, the surface of the membrane being covered with slightly viscid, watery

serum, which gives it a glassy, semitranslucent aspect."

During an attack of hay-fever the **erectile tissues** of the nasal passages and the posterior throat become distended, the blood-vessels are engorged, groups of lymph-cells fill the lymphatic spaces, the mucous surface is crowded with migrating leukocytes (white blood-corpuscles), younger epithelial cells are vacuolating and proliferating, secretion is increased in quantity and altered in character and composition, sensation is heightened, intensified, altered, or benumbed, and the whole metabolism of the affected region is profoundly disordered. Examination of the lower borders of the turbinated bones will disclose the mucous membranes of the nasal cavities arranged in thick, loose folds, owing to the peculiar distribution of the network of arteries and veins which go to make up "**cavernous tissue.**" It is peculiar to this tissue that it may suddenly be engorged with blood, extremely distending it, and as suddenly emptied and the engorgement relieved. It is especially thick over the inferior turbinated bones and over the lower and posterior part of the nasal septum, and also upon the lower edge of the middle turbinated

bone. In acute conditions the engorgement and distention soon subside. In chronic states the mucous membrane becomes markedly thickened and the blood-vessels enlarged and tortuous. The subsidence of the engorgement can not occur, and as a result there is a greater or less degree of closure of the nasal passages.

The mucous membrane of the nasal cavities in hay-fever does not present the characteristic features of an acute inflammation. The impact of pollen or exciting irritant causes complete relaxation of the large veins of the turbinated bodies and an exudation of serum, which relaxation continues so long as pollen or the irritant is *in situ*, but as soon as it is removed the normal caliber is again restored and the attack subsides. Deviations of the septum or chronic rhinitis are occasionally found concurrent with the disease, but can not be regarded as characteristic.

DIAGNOSIS.

Hay-fever may be distinguished from asthma, common catarrh, bronchitis, acute rhinitis, remittent fever, and catarrhal conjunctivitis. The salient feature of hay-fever is its periodicity or annual recurrence. This is part of its very nature, is the central point of diagnosis, is its chief characteristic, and to its elucidation, Holmes says, all existing theories tend. Beard states that hay-fever is like asthma in the following points:

1. It is hereditary;
2. It is more or less periodic;
3. It is paroxysmal;
4. It is correlated to other functional nervous affections;
5. The paroxysms are excited by great variety of irritants; persons being differently affected;
6. It is singularly obstinate and is relieved by the same remedies.

Bosworth considers hay-fever dependent upon:

1. A neurotic habit;
2. Pollen in the atmosphere;
3. A disordered condition of the nasal passages.

While asthma is dependent upon :

1. A general neurotic condition ;
2. Obscure conditions of the atmosphere ;
3. Diseased bronchial (not nasal) mucous membranes.

It is the comparative suddenness of the onset as well as its sudden departure, the violent paroxysms of sneezing, and the character of the nasal discharges which are the peculiar features of hay-fever. The first attacks are likely to be mistaken for ordinary *coryza*, but here the abrupt onset, the characteristic edematous puffiness of the eyelids, the absence of constitutional symptoms will indicate the difference. In children, moreover, attacks of hay-fever are most liable to be mistaken for acute colds or rhinitis,—but here, again, the above points may serve to distinguish, together with the sequence of the symptoms, the time of year, and the physical signs of an acute bronchitis, if it extends so far. The approach of cold weather and the coincident departure of the symptoms will make clear a diagnosis, while the history of previous attacks at the season of the year most favorable to hay-fever, the presence of certain irritants, and the general condition of the bodily symptoms

may be of aid in distinguishing the affection. In acute rhinitis there are several stages, viz.: First, a dry stage, lasting for a few, say twelve, hours; second, a serous discharge lasting two or three days; and, third, a mucopurulent discharge for from three to five days,—while the entire attack runs its course in from five to ten days if no complications ensue. In hay-fever there is no dry stage; the discharge from the outset is purely serous and never mucopurulent during the entire course. The nasal discharge in hay-fever is sometimes slightly opaque, and it may contain some few epithelial cells and viscid mucus. In acute rhinitis examination of the nares will show an inflammatory area while hay-fever shows none. Hay-fever is a vasomotor paresis, and is easily diagnosed from inflammatory coryza by the swollen bluish-gray appearance of the inferior turbinated bones, and by the fact that the first train of symptoms continues through to the end. Examination of the nares will disclose occlusion due to the swollen turbinated bones lying in contact with the septum. The appearance of the mucous membrane itself is characteristic and only slightly resembles an inflammatory process. It is mark-

edly swollen, not bright red as in rhinitis, but bluish-gray, covered with a thin, slightly viscid, watery serum, giving it a glassy, semitranslucent, at times opalescent appearance. Again, the marked puffiness of the eyelids, the great suffusion of the eyes, the photophobia, and even epiphora are distinguishing features of hay-fever.

The sensitive areas spoken of, particularly those on the lower and posterior parts of the septum and the inferior turbinated bones, are of value in differentiating hay-fever, and the markedly pronounced paroxysms of sneezing are very prominent in hay-fever.

People are subject in the changeable climate of spring and early summer to catch colds, and especially is this true of those prone to catarrh. These cases are sometimes mistaken for hay-fever. The readiness, however, with which they yield to anti-catarrhal treatment shows their nature.

PROGNOSIS.

The prognosis is invariably good as to life. Sufferers often live to advanced ages. Hay-fever is **no bar to life-insurance**, but unless rationally treated the chances of permanent cure are very small. There are few exceptions to the rule that the tendency is, when once established, to an annual recurrence, unless the predisposing causes are removed, or there is removal of or away from the exciting cause. Beard states that hay-fever has **no effect on longevity**, and that, judging from observation and analogy, this affliction may act as a kind of safety-valve for the nervous diathesis, preventing other and more serious disorders, and thus becoming the friend rather than the enemy of life. When once attacked, unless properly treated, escape is rare in any subsequent year. Even changes in constitution in extreme age are no bar or protection. It rarely skips a year, provided locality and influence are the same. Absolute immunity is only obtainable at the price of temporary exile. There is no proof that hay-fever is generally milder or

severer in certain years all over the world or over a country, yet evidence is satisfactory that in certain localities it varies greatly in different years.

Now and then, but not often, the tendency to the disease seems to be outgrown. In one of Beard's cases the disease skipped two years. Dr. Gibbons, of California, mentions a terrible case in which the attacks in successive years became lighter and lighter and finally disappeared entirely.

With respect to increase or decrease of severity of symptoms with advancing years there is no constant law. In some cases the disease grows milder, in others severer, in others still, years of comparative mildness alternate with years of comparative severity. The early form may change into the later form. There is no doubt, however, that attacks may change from the early to the late form, and *vice versâ*, and in advancing years may be milder. Bosworth states that the younger the patient the better is the promise of relief; and that rose cold, belonging more especially to early life, is to be regarded more favorably than other forms. Macdonald

has observed spontaneous disappearance in children, perhaps due to an increase, *pari passu* with growth and development of nervous stability.

As regards the termination of each individual attack the prognosis is invariably favorable; *ces-sante causā, cessat effectus*. There is almost equal certainty that with the same causative influences the attacks will reappear upon exposure to the exciting cause. It is peculiar, too, that the disease of one year's standing has proven as obstinate as one of from twenty to thirty years' duration. In these instances, it may be a question as to how firmly fixed has become the neurotic habit.

W. W. Bulette, of Colorado, in 1896, as a result of his own experience, made the assertion that more than eighty per cent. of hay-fever sufferers can be permanently and effectually cured. Thorough examination of the patient and elimination of every possible source of irritation and pathologic condition is necessary.

I desire to be more emphatic, and from my results in the treatment of over 200 cases during the last ten years, I believe that the curability of the disease can not be questioned. That all cases can be cured is questionable; but we can unhesitatingly say that a

majority of cases are curable, and that positive relief, without change of residence or inconvenience, can be afforded during the period of occurrence, if treatment is directed along the lines laid down in the following chapter.

TREATMENT.

The proper treatment of hay-fever has always been a subject of many and diverse opinions; and the so-called specifics have been as numerous as the theories of causation. From time to time, nearly every drug in the pharmacopeia has been employed; and many have been fashionable for a very brief period and finally abandoned. The antiseptics, the antispasmodics, the escharotics, the astringents, and the sedatives have one and all had their advocates, have flourished and fallen into disuse. Early in my experience in the treatment of hay-fever I shifted from drug to drug, gradually eliminating complex formulæ, until finally I employed exclusively the simple methods herein described. During the last ten years I have had under my care over 200 well-marked cases of hay-fever, of which I possess, in nearly all, complete histories, and I have not failed to relieve a single patient who has persisted in the treatment. I not only prevented the paroxysms, but subdued their violence and controlled the attacks when well established. I am free to confess that I secured

success rather empirically, and not until many stubborn cases had yielded could I deduce satisfactory conclusions.

The logical parallel of my methods is found in antiseptic surgery. The ponderous technic of Lister is now replaced by simple antisepsis or surgical cleanliness; so the simple, though strict, sterilization of the nasopharynx is the certain means of arrest of the painful phenomena of hay-fever. By a *daily sterilization* of the nares and postnasal spaces the victims of hay-fever may remain in the city attending to their usual duties, surrounded by dust, or in the country amid blooming flowers, without any fear of the distressing symptoms—a consummation devoutly to be wished for by the great army of hay-fever sufferers.

Some years ago, in the dispensary, I made a somewhat prolonged bacteriologic study of the nasal secretions of young children waiting for treatment for various simple disorders, and it was found that although a child might have no constitutional indication of the disease whatever, often the bacteria of diphtheria, scarlet fever, measles, whooping-cough, or tuberculosis were present in the nasal secretions. Thus I was led to appreciate

the well-known fact that the various bacteria deposited in limited numbers on healthy nasal mucous membranes ultimately perish. Unless the general vitality and resistance of the mucous surfaces are lowered by internal causes, or an entrance is made through some local lesion, possibly the result of previous disease or injury, unhygienic environment, or overwhelming exposure, hay-fever will not occur. Conceded that an external irritant is necessary to cause the disease, to prevent or cure it we must either prevent the irritant from reaching the points of exposure, fortify these vulnerable spots, or remove or render inert the irritant when already lodged. In hay-fever the vulnerable spot is undoubtedly somewhere within the nasopharynx. It is now conceded that the nose and throat are entrances for the bacteria of many infectious diseases; and I feel sure that as I have limited the extension of house-epidemics of scarlet fever, diphtheria, whooping-cough, and measles by a carefully conducted antiseptic toilet of the nose and throat, in the same manner I have prevented the dreaded paroxysms in cases of hay-fever.

All writers on this subject advocate vaguely the

treatment of the nose and adjacent parts; but almost invariably definite nasal treatment is directed to previous local disease or to the employment of escharotics, astringents, or anesthetics. Antiseptic solutions are advised for their local action rather than with an idea of cleansing the nares, and are used in quantities too small to remove or render inert the irritant. Removal from the source of irritation—a complete change of environment during the period of recurrence—has been the best prophylactic means previously at our command, but this is most inconvenient and impracticable to many of the sufferers. Equally impracticable is such an alternative suggestion as that of Morell Mackenzie, that when people can not flee to the mountains or the mid-ocean they should remain indoors, and “if they must go out they ought to plug the nose with cotton-wool and protect the eyes by wearing spectacles with large frames, accurately adapted to the circumference of the orbit.” I offer as an acceptable and reliable substitute for the change of climate a simple local treatment.

The infection and disturbance of the nasal mucous membrane is undoubtedly the exciting

factor in originating the paroxysms, and to this we must confine our efforts if we are to gain success in treatment.

The first step in the local treatment is to learn, by careful examination of the nasal chambers, whether we have present any abnormal condition which renders their mucous surfaces supersensitive, or any well-marked defects, such as polypi, deviated septums, or hypertrophies. Frequently a simple chronic rhinitis precedes a tendency to permanent turgescence of the whole nasal chamber; in such a case a free cleansing of the nasal mucous membrane is quite easy, but when we have a polypus blocking the way, or a badly deviated septum, progress in treatment will be slow. I believe that, as a rule, local disease is only incidental and not in any way provocative, except as it renders the surrounding mucous membrane unhealthy, thus inviting infection and precipitating the true paroxysms.

However, any abnormal condition existing in the nasal avenues must be corrected so far as possible, because it renders complete sterilization of these parts difficult or impossible, and weakens the normal resistance of the mucous membrane, thus

inviting periodic infection. I believe that the acute infective diseases, particularly in children, may be prevented by most thorough and repeated sterilization of the nasopharynx, and just as house-epidemics are never excusable evils so I claim the same to be true of hay-fever.

Local Treatment.—The important result to be obtained through treatment is the prevention of the paroxysms, and, ultimately, the entire removal of the recurring *habit periods*. Years ago I was led to treat my hay-fever patients suffering with watery nose, weeping eyes, and bronchial and frequently asthmatic cough by cleansing the nasopharynx with a hand-ball atomizer containing a warm solution of boric acid (ten grains to an ounce of water) or Dobell's solution, after which I carefully wiped the mucous membrane and applied menthol and liquid cosmolin freely to the parts. This procedure afforded considerable temporary relief in a large number of cases when there was present simply turgescence of the whole nasopharynx. When, however, polypi or evident hypertrophies existed this treatment was not sufficient. After the polypi were removed or the hypertrophic tissue destroyed I would continue

the alkaline wash, practising the sterilization and applications to the parts with my oily solution. It would be a long story to trace in detail the gradual abandoning of one drug after another from the mildest alkaline wash up to the strongest caustic application of Williams—the solution of the iodid of mercury of the strength of 1 : 1000 up to 1 : 250. The chromic-acid application, nitrate of silver, carbolic acid, tincture of iodin, quinin solution, perchlorid of mercury, and many of the more powerful caustics and tissue-destroying applications so frequently resorted to in the early history of the treatment of the disorder, I have long ago discarded. These remedies, while sometimes possessing merit, were not lasting, and were frequently more painful than the paroxysms they were supposed to check; they could only be resorted to in those hopeless cases in which the patient would willingly suffer any pain rather than the distressing hay-fever paroxysms. The stronger solution of iodid of mercury (1 : 250) was so very severe as to often necessitate an hypodermic injection of morphin to control the agony, and in addition it produced an acute catarrh of a severe type lasting several days.

All of the severe caustic remedies have in turn occasionally proved of value ; but my experience of late years has led me to avoid all powerful applications. For the last ten years I have used the ordinary Dobell's solution :

R. Sodii bicarb.,
 Sodii boratis,aa ℥ iss
 Acidi carbolic, ℥ ss
 Glycerini, ℥ ij
 Aquæ rosæ, 25 per cent., . . q. s. . . Oj.
 SIG.—Teaspoonful to one ounce of warm water.

This I thoroughly use in both nostrils, first by means of a hand-ball atomizer, after which, with a curved aluminum applicator or Harrison Allen's nasal cotton-carrier, I very carefully swab the whole nasopharynx. *I scrub most carefully every portion of the mucous membrane, being sure to reach between the turbinated bones and all around and over every slight prominence.* I then as carefully dry the membrane with clean cotton, and use freely blandine comp. (a mild solution of menthol in albolene), loosely plugging the nose for a few minutes to retain the oily application. It is important to most thoroughly sterilize the three sensitive areas of the nose, as we are unable

to determine whether one or more may be affected, and by this mild yet thorough treatment we cleanse effectually the whole nasal chamber.

The rigid simplicity of this form of treatment has been such that for a long time I doubted the real extent of its value, but as so many extreme sufferers have expressed their great relief and were willing and anxious for me to continue the applications, I have concluded to offer my methods in full confidence of their reliability, with a warning that for successful treatment the directions of cleansing and scrubbing must be followed in the strictest detail. Good results need not be expected by simple irrigation and swabbing—the whole nasal mucous membrane must be thoroughly washed and scrubbed before the oily applications are used.

Surgical Treatment.—Only when gross lesions exist is surgical treatment indicated, and then it should precede the usual sterilization methods. Indeed, so frequently successful has the thorough cleansing of the nares been, that in many cases of gross hypertrophy I have neglected removal. If, however, the sterilizing and cleansing treatment did not bring relief, I would resort to the galvano-

cautery or needle for hypertrophy, or the snare for polypi, after which my nasal cleansing process would be satisfactorily continued. In cases of deviated septum I rarely felt the necessity for correction, but most carefully followed out the thorough cleansing, unless the case presented itself some months before the expected paroxysm, when correction could be made most safely.

A large percentage of my patients during the last five years, anticipating the periods of recurrence, have willingly presented themselves for an annual course of preliminary local treatment. This is extremely necessary to successfully destroy the nerve-habit and to effect a cure.

Prophylactic, Hygienic, and Systemic Treatment.—In old cases, when the nerve-habit has long been formed, treatment should commence at least two or, better, three weeks before the anticipated recurrence of the paroxysms. All bodily irregularities must be corrected and tendencies to constipation or dyspepsia removed. Amylaceous indigestion should be corrected by the exclusion from the dietary of too starchy foods. For the elimination of excessive uric acid, or other waste products, and to relieve constipation, the systematic

administration, morning and night, of effervescent sodium phosphate is invaluable. If the appetite is not good, the regular use of the tincture of nuxvomica, ten to twenty drops three times a day, is strongly indicated. In anemic cases pills of carbonate of iron or, probably still better, the pills of valerianate of quinin, iron, and zinc are necessary. In nervous cases with anemia, valerianate of zinc, one grain with two grains of the compound asafetida pill, two or three times a day (after Morell Mackenzie), will be found valuable. Careful diet, a tranquil mind, and moderate exercise are essential. Outdoor exercise, with a daily tepid bath followed by vigorous friction of the whole body, will serve to eliminate waste material. The patient should not unnecessarily expose himself to direct rays of the sun, as they are calculated to excite intense reflex irritation of the sensitive nerve centers. Much trouble may be averted by the use of a sunshade or umbrella and by the avoidance of exercise in the sun.

It must be understood that with this general hygienic and constitutional treatment the course of local prophylaxis by daily sterilization is most necessary.

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